FOREST PRODUCTS
Project Fact Sheet

GENETIC AUGMENTATION OF SYRINGYL LIGNIN IN LOW-LIGNIN ASPEN TREES

BENEFITS

- Increased pulp yield
- Decreased cost and energy use in pulp and paper production
- Enhanced wood growth and properties

APPLICATIONS

The technology can be used to genetically enhance properties of aspen trees. The biotechnology developed during the project is readily applied to other important pulpwood species, such as cottonwood and sweetgum.

Genetic Engineering of Wood Properties Can Increase Pulping Efficiency in Aspens

The removal of lignin from wood for papermaking is a costly, time-consuming procedure hindering pulping efficiency. The focus of this project is to improve pulping efficiency by genetically modifying lignin content in wood. By manipulating both the quality and quantity of lignin in aspens, researchers at Michigan Technological University (MTU) can use genetic engineering to help mills increase pulping yield and decrease pulping costs without affecting wood growth.

Previous research at MTU has revealed a gene that can reduce lignin content in wood without adverse effects. This project will build from those findings, altering lignin quality in transgenic aspen trees in order to increase the rate of lignin degradation during the pulping process and consequently improve pulping efficiency. The resulting technology replaces the traditional breeding processes used to select desirable clones.

OFFICE OF INDUSTRIAL TECHNOLOGIES
ENERGY EFFICIENCY AND RENEWABLE ENERGY • U.S. DEPARTMENT OF ENERGY

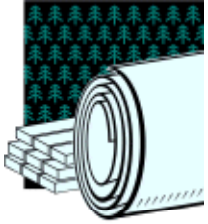
PROJECT DESCRIPTION

Goal: Genetically augment S/G lignin ratio in 4CL1 transgenic aspen in order to produce aspen trees with reduced lignin content, more reactive lignin structures, increased cellulose content, and enhanced growth.

Previous efforts to reduce lignin content have reported stunted growth, but recent laboratory findings indicate that manipulation of the lignin-specific 4CL gene may efficiently produce trees with a growth advantage and low lignin content. This project will yield an additional advantage to pulping efficiency by engineering high syringyl/guaiacyl (S/G) ratios in the lignin of transgenic aspens. Genetic augmentation of S/G has been shown to increase the rate of lignin degradation during pulping. Researchers will also focus on developing pyrolysis Molecular Beam Mass Spectrometry (pyMBMS) calibrations for rapid, reliable, and cost-effective evaluations of cell wall components (i.e., lignin, carbohydrates, and extractors) of transgenic wood samples.

PROGRESS & MILESTONES

- MTU will prepare the two gene constructs.
- The prototype was evaluated on the ABB Dynamic Tester and yielded accurate results.
- NREL will conduct pyMBMS calibrations for aspen plants
- MTU will transform the aspen and transfer them to a greenhouse.
- MTU will analyze molecular, biochemical, and wet-chemical properties of the trees.
- NREL will use pyMBMS to characterize transgenic aspen



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